

MEASUREMENT OF THE $^{90,91,92,94,96}\text{Zr}(\text{n},\gamma)$ CROSS-SECTIONS AT n_TOF

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The (n,γ) cross-sections for the stable Zr isotopes have important implications in nuclear technologies as well as for studies in the field of nuclear astrophysics. In particular the NEA “High Priority Nuclear Data Request List” [1] ask for a fine cross-section determination for (n,γ) reactions from thermal to 1 MeV neutron energy.

The innovative features of the n_TOF CERN facility, and in particular the very high instantaneous neutron flux [2], the high resolution and the low background results in the possibility to obtain a very good signal-to-background ratio for such measurements, thus allowing for an accurate determination of the relatively low capture cross-section for these isotopes. In particular the goal of these measurements is to improve the definition of cross-sections and resonances parameters, reducing the uncertainties of a factor three, with respect to the previous available experimental data.

After the description of the experimental apparatus, based on C6D6 detectors, we will present a detailed discussion of the data analysis, which is based on the Pulse Height Weighting Technique. A careful analysis of the different background components has been performed by means of suitable measurements with Pb samples, as well as with black-resonance filters. After the determination of the capture yield, accurate cross-sections for the stable $\text{Zr}(\text{n},\gamma)$ reactions are then extracted. The results on the analysis in the resonance region are presented together with the cross-section for the unresolved resonance region. A discussion on the estimated magnitude of the systematic uncertainties will be presented.

References

- [1] “The NEA High priority Nuclear Data Request List”, Status in May 1998, OECD-NEA Nuclear Science Committee.
- [2] Proposal for a Neutron Time of flight Facility, CERN-SPSC 99-8, SPSC/P 310, 17 March 1999.